School Size, Violence, Cost and Achievement
A Report of the Commission on Business Efficiency of the Public Schools
Commission's Executive Summary

SOURCE AND BACKGROUND

The Commission on Business Efficiency of the Public Schools responds to requests from members of the Legislature as well as from its direct members. Assemblyman Louis Greenwald asked the Commission to consider examining the relationship of school size and violence in order to determine if there exists a causal link between the variables. The Commission discussed this issue and determined that there was a possibility of a significant link between school size and violence. However, the members of the Commission were concerned that an analysis of these two variables alone might lead to conclusions which would a) negatively affect other important public values and b) provide an incomplete picture leading to inappropriate decision making. The two values the Commission believed most likely to be negatively affected by decisions based on an analysis of size and violence alone were student achievement and cost. As a result the Commission decided to include achievement and cost in the examination. Further the Commission thought that if a link exists and it is sufficiently significant, this link might be important on a policy level at this time in New Jersey. Currently, school districts in New Jersey are in the process of building new schools as a result of a recent building bond in excess of $8 Billion. The Commission felt that information regarding school size and how it affects school performance and operation could be valuable to decision makers at both the local and State levels.

In the past examinations of size as it relates to New Jersey education has focused primarily on district size and class size. School size has not received significant attention from policy makers. The studies on district size have had mixed results. Some studies have suggested that district size should be increased to realize benefits from economies of scale. Other studies have suggested that the economies of scale, if they exist, may be offset by diseconomies of performance. Still other studies (including one by the Commission) have suggested that many of the benefits of economies of scale can be achieved through increased cooperation between and among districts and other governmental entities in the form of shared services.

The validity of these studies not withstanding, regionalization of small school districts into larger ones seems to have reached a plateau in New Jersey. If structural

changes toward efficiency are to be made in the near future, it seems unlikely that they will take the form of increased regionalization.

In New Jersey, public elementary and secondary education is a major budget issue. At the state level, it claims more than $8 billion of the state budget (2004 fiscal year projected). At the local level, taxpayers contribute an additional amount in excess of $10 billion annually.

Though funding has dramatically increased, so have recent reports of violence in many districts. Problems of absenteeism and dropouts continue to plague far too many schools. Achievement has remained largely unchanged. While the problems underlying these issues seem, to some, immutable, the Commission believes that it is important that the State continually seeks to identify, articulate and solve such problems. Failure to do so would be irresponsible.

Recent research indicates that at least a part of the solution to these problems lay in the size of individual schools. In some studies small schools appear to be producing lower violence, higher achievement and may contain cost advantages as well.

The basic questions for this study deal with the relationship between and among these variables. Specifically, is there a relationship between and among the independent variable school size and the dependent variables violence; achievement; and cost?

To answer these questions the Commission contracted with Professor Russell Harrison of Rutgers, the State University.

Under the direction of the Commission, Professor Harrison (1) conducted an initial review of the research literature in academic journals, books, and research reports to understand the current thinking regarding school size, violence, achievement and cost; (2) evaluated alternative definitions of school size, violence, achievement and cost; (3) collected, analyzed, and evaluated the data available at the state level on these variables to determine if a sufficient relationship exists to warrant further and more extensive research and (4) prepared the research findings in a form that is useful in the education debate.

This resulting report serves as a preliminary examination to determine if more detailed study is warranted.

POLICY PROBLEM

The problem addressed in this paper is to investigate and identify possible alternative organizational approaches, which may help to improve the efficiency and effectiveness of New Jersey Public Schools. Specifically the issue addressed is to determine if sufficient evidence exists to recommend that the Legislature seek to encourage smaller school size. In this context school size means the size, in pupils, of organizational units providing direct education services to a defined group of children. In common language: the number of pupils who attend an individual school. Here, a school is usually a school building, but may also be a school-within-a-school. A school-within-a-school exists where multiple, separately, administered schools exist within a single school building.

METHODOLOGY

In conducting the research the contractor was directed to determine, at the 95% confidence level, if there exists a relationship between and among the independent variable size and the dependent variables violence, cost and achievement. In research terms, the contractor was asked to seek to prove that any relationships between or among school size, violence, achievement and/or cost are coincidental (the null hypothesis). Failing to prove that at the 95% confidence level, he was to reject this theory in favor of the conclusion that these relationships do indeed exist and to explain the direction of the relationship (positive or negative).

In conducting the research publicly available data relative to each of the variables were used. The statistical analysis was performed by measuring differences in mean values of the dependent variables for different values of the independent variable, analysis of variance for those differences, and multiple regression analysis.

The research regarding violence and achievement was limited to high schools due to the quality of data available regarding achievement and violence. Another reason for this focus is that problems of anomie and alienation have serious consequences in high schools. Student violence and school crime literally become matters of life and death.

Moreover, high school students are more apt to skip school or be absent on their own volition. They are also more likely to get into major problems with the law while playing hooky than elementary school students. Thus both misbehavior in school and absenteeism from school can have serious immediate consequences for high school students.

The combination of poor grades and dropout risks are also serious problems in high schools. In high school, far more so than earlier grades, students performing poorly or missing class are much more likely to leave school. Poor grades, absenteeism, and dropouts push students off the ladder to middle class prospects into a culture of poverty from which escape is difficult. In the culture of poverty they face a morass of problems for themselves and for society as a whole. Areas with more dropouts are especially prone to suffer from other non-school related problems like births to unmarried females, homicides that lead to incarceration in adult prisons for males, deficient care for children, both unborn and born, and elevated risks of infant death. Tax payers may face extra costs for public health care and corrections where dropout rates escalate.

Data on costs included both high schools and all schools.

SAMPLES AND DATA

As mentioned above the samples used in this report for achievement and violence were restricted to high schools. For each analysis a different sample was used to demonstrate that the effects were not dependent on a single sample. Details of the samples are included in the appendices.

The HSPT passing rates for each of the three parts of the test (math, reading and writing) were used as surrogate measures of achievement.

Statistics gathered by the New Jersey Department of Education in 2000 were used to measure violence, which included the most serious school incidents.

The cost measures used spending per pupil from the various school years as reported by New Jersey Department of Education in its State Report Card. District spending was used due to the lack of available data for individual schools. Several

different cost measures were also constructed to measure educational value received per dollars spent.

DISCUSSION OF THE THEORY

What is the relationship of school size with school crime, poor test scores, and inefficiency in educational service delivery? Does a careful review of evidence for a sample of New Jersey schools produce findings sufficient to show that any apparent relationships between the variables is more than coincidence?

Communities face special problems where problems of academic failure, low test scores, student violence, school crime, absenteeism, dropouts, are combined with inflated school budgets. Parents of high school students tend to have a longer earning record and larger savings than parents of elementary children. They are more apt to own or consider home ownership, and are especially sensitive to local tax burdens to fund schools. If schools are both expensive and ineffective, they are apt to vote "with their feet". Parents of high school students are especially prone to flee an inefficient school system, especially where options are close at hand.

This loss of middle class families from the school and the larger community further compounds the problem of academic progress for those left behind, and impedes the realization of vital educational goals. Thus endogenous educational problems produce a downward spiraling cycle of mutually reinforcing educational failures.

Many variables shape educational problems. However, this research was designed to test a theory that school size is a major exogenous variable shaping the endogenous problems that plague many public school systems, including high schools.

If this theory is valid, then large schools and school size should be seen as major explanations for differences in overall inefficiency at the high school level. To the extent relationships of school size with inefficiency problems are highly significant, then public officials in New Jersey should take heed in future debates about educational best practices, optimal architectural design, and rational planning for education governance and administration.

SIGNIFICANT FINDINGS

Following are the significant findings of this preliminary examination as they relate to each of the dependent variables achievement, violence and cost.

Finding I Small schools have significantly higher test scores than large schools.

One task for this project was to estimate relationships of school size with test scores on High School Proficiency Tests (HSPT). The tests measure student success in mastering math, reading, and writing skills respectively.

Passing rates on the three tests were dramatically higher depending on the size of the school. For instance, the passing rate on the math portion of the HSPT was 9.5 percentage points higher, on average, in schools with 500 or fewer pupils than in schools with 1500 or more pupils. The differences in writing and reading were 9.1 and 14.5 percentage points respectively. The results are found in Section 1 of the Full report.

Finding II Small schools have significantly less violence than large schools.

In estimating the relationships of school size with student violence and school crime, data from the New Jersey Department of Education's "*Violence, Vandalism and Substance Abuse in New Jersey Schools – 1999-2000*" was used. The evidence is clear, looking at a sample of high school districts in New Jersey.

The size of district schools is positively correlated with the concentration of student violence and school crime in a given district. This result is analogous to prior research on school segregation. This study shows that school size is also significantly correlated with the concentration of violence and crime in one district versus others. The size of the average school in each district is significantly correlated with violence and overall criminal incidents for districts serving a majority high-school students.

Using a tipping point for school size of 1000 pupils, small schools on average (mean and median) experience between 29 to 40 percent fewer incidents of violence than do all of the schools in the sample. Schools with more than 1000 pupils experience between 58 and 108 percent more incidents of violence. The results are found in Section 2 of the Full report.

Finding III Expenditures per pupil vary with school size and type.

Step 3 of this project was to examine available data to determine (1) if a relationship exists between school size and fiscal cost, and (2) what the nature of that relationship is if it exists.

Note: This part of the analysis uses direct school expenditures only. Costs external to the school district are examined later in the report and discussed in other findings.

In general expenditures on a per pupil basis for smaller high schools were higher than the costs of larger schools. However, the variance in districts of all types (including elementary and middle schools) was far from a simple straight line.

The data related to the following sub findings can be found in *TABLE 3A2:The ratio of fiscal costs in a given year* on page 46 of the full report.

Finding III a. Small high schools with less than 500 pupils have higher expenditures for operation on a per pupil basis than large schools and lower expenditures per pupil than schools in the 500 to 999 range.

High Schools under 500 pupils experienced costs per pupil 1.4 percent higher than the mean for the all high schools in the sample. This represented a difference of $117. These schools had expenditures $726 per pupil higher when compared to high schools with more than 1500 pupils representing a difference of 9.5 percentage points around the mean.

This shift in difference in cost when compared to the difference in achievement may indicate that the most efficient high school size is somewhere near or below 500 pupils. However, this is examined in more detail later in the report.

Finding III b Small high schools with 500 to 1000 pupils have significantly higher expenditures for operation on a per pupil basis than schools with 1,500 or more pupils.

High Schools with 500 to 999 pupils experienced costs per pupil 2.8 percent higher than the mean for the all high schools in the sample. This represented a difference of $233. When compared to high schools with more than 1500 pupils these schools had expenditures 11.0 percent higher representing a difference of $842 per pupil.

Finding III c. Small schools with less than 500 pupils have higher expenditures for operation on a per pupil basis than large schools.

When the focus is shifted to include schools at all levels, the variances are much different. Schools under 500 pupils experienced costs per pupil 3 percent higher than the mean for all schools in the sample or $243 per pupil. On a percentage basis this is a larger gap than for the same population class in high school only comparisons. However, when compared to all schools with more than 1500 pupils the difference shifted from 9.5 percent in the high school comparison to 8.8 percent in the all schools comparison. This 8.8 percent difference represents a $665 per pupil difference.

Finding III d. Schools with enrollments between 500 and 1000 pupils have slightly higher expenditures for operation on a per pupil basis than large schools.

The difference between schools with 500 to 1000 pupils and was only 0.5 percent or roughly $35 per pupil higher than those with 1500 or more pupils. This class of schools had expenditures lower, in this comparison, than both the smallest schools and those schools with enrollments between 1000 and 1500.

The significance of this is the indication that optimal school sizes are likely different for schools of different types. That is an ideal size range for a K-6 school is different that for a high school.

One possible explanation is simply that small schools with 500-1000 students face fewer of the unique challenges of the other even smaller schools serving fewer than 500 students. To house their students and meet their challenges, schools with 500-999 students do not have to spend a lot more than other schools. In fact, they spend a lot less than other schools.

Finding IV Small schools have significantly higher value per dollar spent than large schools.

While the cost of educating a student in varying sizes of school is valuable, it is important to examine the other social values realized by schools in combination with the immediate fiscal cost.

Step 4 of this project was to examine the interrelationships of all four variables under examination in this study simultaneously in order to understand the cost/benefit of changes in schools size. To accomplish this, several approaches were used.

(1) Four separate indices were constructed to show fiscal cost, cost adjusted for expenditures by other governmental units incurred relative to dropouts, cost (through enrollment adjustments) of increasing proficiency test passage rates, and costs adjusted for both dropouts and passage rates.

(2) Construction of "Composite Inefficiency" scores to measure not only fiscal costs but also social and academic costs and to measure than over time.

The approaches use varying enrollment break points to examine the sensitivity of the results to differing groupings of enrollment size. These measures show consistently a higher value achieved per dollar spent for smaller schools.

Parts of Section 3 and Section 4 of the full Report demonstrate these results.

RECOMMENDATIONS

While the Commission finds that there are significant fiscal and social advantages to smaller school size, the Commission also finds that the current research is insufficient, for the most part, to support specific policy recommendations. Additional research should be done before specific school size recommendations can be made. However, the Commission also believes that sufficient proof has been shown to warrant both additional research and serious consideration by school districts embarking on construction projects of the planned capacity of those projects

Action Recommendations

Recommendation One: The research indicates that, in High Schools, a cost/benefit tipping point exists somewhere between 500 and 1,000 students. While further study should be done on this topic, districts considering school sizes significantly higher than 1000 should consider multiple small schools as opposed to large single schools.

Recommendation Two. School districts with existing high school facilities or which are in the process of constructing facilities with enrollments over 1,000 pupils should study the feasibility of creating separate administrative units (known as "*schools within schools*") within these school buildings.

Research Recommendations

Recommendation Three. Studies should be conducted to identify separate, useful enrollment targets for elementary, middle and high schools. These studies should take into consideration the costs, both direct and indirect of 1) facilities and maintenance, 2) achievement and 3) violence.

Recommendation Four. A study should be conducted to examine the relationship of school size to problems affecting middle school and junior high school students in particular, including failures on GEPA tests, school crime and violence, school climate and performance in high school.

Recommendation Five. A study should be conducted to examine and analyze nationwide surveys to link school size with the costs of construction, maintenance, and transportation

Recommendation Six. A study should be conducted to examine and analyze nationwide surveys to link school size, parental alienation, and lack of involvement by parents in elementary middle and high school levels.

Recommendation Seven. A study should be conducted to examine and analyze nationwide surveys that link school size with the loss of consensus and rapport between teachers and principals

Recommendation Eight. A study should be conducted to examine and analyze nationwide surveys that link school size with physical conflicts and fear as problems facing schools